The impact of venture capital investment duration on the survival of French IPOs

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Abstract: Using a sample of 212 IPOs, this paper analyzes the impact of venture capital involvement on the survival time of French IPOs. We find that the ability of venture capitalists to improve the survival of companies is related to the duration of their investment. We show that venture capitalists do not create additional value if investment duration is too short while longer duration allows venture capitalists to monitor the firm efficiently. Our paper provides some interesting results that qualify the findings from empirical studies that highlight the absence of a positive effect of this financing on firm performance in France.

Keywords: Venture Capital, IPO, Survival, France

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1. INTRODUCTION

Venture capital (VC) firms are financial intermediaries that provide funding to young innovative companies. Several studies of VC agree that a key function of VC firms is to contribute funding but also to provide expertise and value-added services to their portfolio innovative companies. According to Gompers and Lerner (2004), venture capitalists provide pre-investment screening, post-investment monitoring, and value-added. When performed well, these roles of selection, monitoring and value-adding should lead to improved performance by portfolio companies (Manigart et al., 2002).

Alongside their traditional roles, VC firms also contribute to the process of going public. Previous researches based on US data show that VC firms' experience helps companies choose the most favorable time for their Initial Public Offerings (IPO) (Lerner, 1994a) and leads to their experiencing lower levels underpricing, providing support for the contribution of certification role of venture capitalists in IPOs (Megginson and Weiss, 1991). On the other hand, Lee and Wahal (2004) for the US during the period 1980-2000, and Chahine et al. (2007) in the French context, find that VC firms are not effective for certifying IPOs. The results for France indicate that French VC firms appear to engage in "grandstanding". However, Goergen et al. (2009) also in a study of the French firms, show that the level of underpricing depends on the length of lock-up. They suggest that if the French venture capitalists are locked in beyond minimum requirements, then underpricing is lower. Similarly, Chahine and Filatotchev (2008) find that French IPOs where VC firms are affiliated to lead underwriters, show lower levels of underpricing than other IPO firms.

Another strand of work analyzes the impact of VC financing on the financial and economic performance of IPO firms. Indeed, Barry et al. (1990), Megginson and Weiss (1991) and Jain and Kini (2000) indicate that venture capitalists continue to be involved in issuing firms' projects even after an IPO. Jain and Kini (1995) argue that VC backing can provide effective monitoring following an IPO but according to Bruton et al. (2010), this post-IPO monitoring has a cost which can limit venture capitalists' efforts to redeploy their assets to new investments. Then the impact of VC firms on IPO performance can be negative rather than positive. The findings for the US indicate that VC-backed IPOs outperform non-VC-backed issues in terms of operating, financial, and long-run performance (see among others, Jain and Kini, 1995; Brav and Gompers, 1997; Jain and Kini, 2000; Megginson and Weiss, 1991). However, there may be important differences in the maturity of VC markets so that findings from the US context may not be generalizable to European countries. Indeed, the results of studies of European IPOs are less conclusive and show that VC-backed IPOs generally do not outperform non-VC-backed issues for operating or financial performance (Bottazzi and Da Rin, 2002; Rindermann, 2003). So, what do we know about the performance of the French VC industry, which is one of the most dynamic in Europe? Prior research on French VC-backed IPOs most focus on financial performance and underpricing (see among others: Chahine et al., 2007; Chahine and Filatotchev, 2008; Goergen et al., 2009; Sentis, 2009). Concerning the impact of VC firms on the economic performance of French VC-backed IPOs, the results of Bruton et al. (2010) show that venture capitalist involvement has a negative effect on the firm's economic performance measured by the adjusted return on assets (ROA) at the end of the year of the IPO. According to these authors, this negative outcome is the

result of less efficient post-IPO monitoring in France compared to other countries such as the UK or the USA. However, we believe that a refined assessment that takes account of the heterogeneity of VC financing is required for a better understanding of its effect on firm performance. Indeed, even among VC firms there is likely to be wide variation in the quality and effectiveness of their monitoring and value added services. Also, considering the variety of their expertise, there is no reason to consider VC firms as a homogeneous group of investors (Jain and Kini, 1995; Dimov and De Clercq, 2006; Bottazzi et al., 2008). So the question becomes not do VC firms add value to French IPOs but rather, *when* do VC firms add value to French IPOs?

In this study, we focus on the effects of venture capitalists' participation in IPOs in France and examine the impact of VC involvement on the long-run economic performance of French IPO firms. Thus, our focus is on the impact of VC involvement on another critical aspect of the going public process, namely, the survival of IPO firms subsequent to their going public (Jain and Kini, 2000; Audretsch and Lehmann, 2004). In line with prior VC research by Wang et al. (2003), this paper argues that the ability of VC to add value to portfolio companies depends, among other elements, on the investment duration. In focusing on VC investment duration, this paper suggests that VC firms cannot be treated as a homogeneous group of investors. This may provide new insights into our understanding of IPO performances in France.

We analyze the impact of VC involvement on the survival of French IPO firms. Our analysis is based on hand-collected data. Our data set includes 215 French companies that went public between 1996 and 2006. This sample allows comparison of the survival times of VC-backed and non-VC-backed IPOs. Empirical investigations indicate that VC firms do not create additional value when investment is in the later stage of development or equivalently when the duration of the investment is too short (less than at least 2 years) while longer investment duration allows venture capitalists to monitor the firm efficiently and to add some value.

This paper provides novel insights into previous work on venture capitalists and IPOs in France. It contributes first to the recent literature on VC-backed IPOs performance, by analyzing the dimension of long-run performance. The question of whether or how venture capitalist involvement improves survival times of IPO issuers has not been explored for France. Our research seeks to redress. It sheds light also on the potential long-run performance differentials between VC-backed and non-VC-backed IPOs. The second contribution is that this paper analyzes VC investment characteristics rather than considering VC financing as a single type of financing.

The remainder of the paper is structured as follows. Section 2 describes the conceptual framework. Section 3 presents the data sources, the variable definitions and the research methodology. Section 4 discusses the main results and Section 5 provides some additional results and robustness tests. Conclusions are presented in Section 6.

2. BACKGROUNG, LITERATURE AND RESEARCH QUESTIONS

The literature on VC shows that there are positive (Sahlman, 1990) and negative (Amit et al., 1990) aspects to financing by venture capitalists. Therefore, the presence of VC does not

necessarily have a positive impact on firm performance. By focusing on the IPO process, the literature identifies three main models for the role of VC firms.

First, the certification model suggests that venture capitalists could certify IPO firm issuings (Barry et al., 1990; Megginson and Weiss, 1991; Jain and Kini, 1995). It is well known that third-party specialists, such as investment bankers and auditors, can help to resolve the asymmetric information inherent in the IPO process (Carter and Manaster, 1990). Megginson and Weiss (1991) explain that this role of certification can also be performed by VC firms. First, venture capitalists are able to reduce asymmetric information due to their direct access to information. Indeed, these insiders often enjoy closer relationships than other financial intermediaries with the managers of the firm (Sapienza et al., 1996). For instance, VC firms can engage in face-to-face interactions with managers, sit on the boards of VC-backed companies (Sapienza and Gupta, 1994; Fried et al., 1998), be involved in recruitment of top managers and in strategy development (Hellman and Puri, 2002). Second, venture capitalists are also large shareholders in the issuing firm, and the retention by VC firms of their holdings after the IPO can act as a bonding mechanism for credible certification (Megginson and Weiss, 1991). This is particularly true in France where lock-up agreements prevent VC firms from selling their shares at the time of the IPO (Goergen et al., 2009). Third, VC firms have very strong incentives to establish a reputation for trustworthiness in order to assure a continuing flow of deals, and to establish enduring relationships with their fund providers (Megginson and Weiss, 1991). So, this reputation requirement should control possible false reputation.
This model is empirically supported by several studies on the US. For instance, Megginson and Weiss (1991) compare a matched sample of 320 VC-backed IPOs and 320 non-VC-backed IPOs in the period January 1983 to September 1987. They find that VC-backed firms enjoy lower initial returns than their counterparts, and are able to attract higher quality underwriters and auditors than non-VC backed firms. Megginson and Weiss (1991) argue that their results are consistent with the idea that VC firms certify the true value of the IPO, and therefore reduce underpricing. More recent studies of European countries indicate that these findings from the US context may not be generalizable to all of Europe. Using a sample of 303 and 141 entrepreneurial IPOs in the UK and France over the period 1996-2002, Chahine et al. (2007) show that VCs are not effective for certifying IPOs in France. However, they found also that UK VC firms are effective third-party certifying agents who reduce underpricing in UK IPOs. For German IPOs, Goergen et al., 2009 show that the average level of underpricing for VC-backed firms is higher than for firms without venture capitalist participation. Their study is based on a sample of 265 German IPO firms that went public between 1996-2000.

Second, the grandstanding model originally proposed by Gompers (1996), signals that VC firms can have incentives to grandstand, or equivalently, to take actions that signal their ability to potential investors. In that case, if the aim is to increase the venture capitalist's reputation with the subsequent objective of raising new funds, venture capitalist may take the portfolio company public too early (after a short financing period). Indeed, most VC organizations raise money in limited partnerships which have finite lifetimes (typically 10

years), so that a VC firm periodically must raise a new fund/a new limited partnership. This puts pressure on young venture capitalists to accumulate good track records to establish reputation and raise new funds within a short time (Gompers, 1996). Consistent with this argument, Gompers (1996) finds that the less longer-established (younger) VC firms need to signal their quality by taking portfolio companies public earlier than would older VC firms.
Gompers (1996) and Lee and Wahal (2004) validate this grandstanding model for the US. They show that IPOs backed by less experienced and younger VC firms are more prone to underpricing. The findings in Wang et al. (2003) for Singapore are similar. For the French case, Chahine et al. (2007) conclude that VC firms appear to engage in grandstanding whereas this is not true for UK venture capitalists. That may explain why, in France, VC-backed IPOs do not overtake non-VC-backed issues for operating and financial performance. However, Chahine and Filatotchev (2008) and Goergen et al. (2009) show that certain types of VC firms may be under less pressure to grandstand in order to raise further funds. For instance, Chahine and Filatotchev (2008) find that IPOs backed by venture capitalists affiliated to more prestigious underwriters show lower underpricing, suggesting that these VC firms are also less likely to engage in grandstanding. They show also that these affiliated VC firms play a more critical monitoring role than non-affiliated VC firms. Generally, it is difficult to select between these conflicting theoretical models: certifying and grandstanding. Hence, the effects of venture capitalist involvement on underpricing remain an empirical issue in Continental European countries and also in the US and the UK.

Third, alongside their certifying role, venture capitalists are responsible for monitoring the companies they finance. Admati and Pfleiderer (1994) show that VC firms are better able than other financial intermediaries to resolve agency problems. Venture capitalists use control mechanisms to manage business risk and reduce agency conflicts inherent in the financing of innovative firms (Sahlman, 1990; Gompers and Lerner, 2004). Among these mechanisms, Lerner (1994) and Gompers (1995) identify the strategies of syndication, use of specific control rights such as convertible securities, and the staging of capital infusions that allows projects to be abandoned at predefined stages (Sahlman, 1990). Besides the monitoring effect, VC firms are also considered to be experts able to add value to their portfolio companies. For instance, the involvement of VC firms can add value through close relationships with the managers of portfolio companies (Sapienza et al., 1996).
This model was first supported empirically by Barry et al. (1990) for the US context. They focus on the monitoring role of VC firms in IPOs between 1978 and 1987 and find that venture capitalists provide intensive monitoring services that « […] appear to be recognized by capital markets through lower underpricing for IPOs with better monitors » (Barry et al., 1990, p. 447). According to their results, the number of venture capitalists involved, the ownership and the length of board service of VC firms lowers IPO underpricing. Turning to the effect of VC monitoring on firm's economic performance, the findings vary. First, focusing on a sample of IPO firms that went public on the US market during the period 1976-1988, Jain and Kini (1995) show that VC-backed IPO firms exhibit relatively superior post-issue operating performance (measured by ROA and operating cash flows on total assets) compared to non-VC-backed IPO firms. However, they also find that both VC-backed and non-VC-backed issuers show declining performance relative to their pre-IPO levels. Like

Barry et al. (1990), Jain and Kini (1995) test the impact of monitoring quality on post-IPO economic performance. They show that it is the number of VC firms with equity position in the pre-IPO firm that best explains the positive impact of VC monitoring on the post-issue operating performance. In the Singapore context, using a data set of firms listed on the Singapore stock exchange in 1987 to 2001, Wang et al. (2003) contradict the results in Jain and Kini (1995). Wang et al. (2003) show that VC-backed IPOs exhibit relatively inferior post-IPO operational performance (measured by ROA and returns on sales) compared to non-VC-backed IPO firms. In order to mitigate their results and to understand why VC firms do not add value, Wang et al. (2003) classify VC-backed firms according to VC duration (long and short investment duration). The results obtained suggest that venture capitalists in Singapore with (only) long investment duration are similar to venture capitalists in the US and might be able to add value to the companies through monitoring. In the European context, focusing on a sample of 303 UK, French and German IPOs, Rindermann (2003) shows that VC firms, taken as a homogeneous group, do not add value to IPOs but that international venture capitalists (only) appear to have positive value added effects on both the operating and market performance of IPO firms. For a sample of French IPOs, Bruton et al. (2010) confirm these results showing that venture capitalists' involvement has a negative effect on the firm's operational performance at the end of the IPO year. All these findings indicate that the heterogeneity of VC firms needs to be considered in order to achieve a better understanding of the venture capitalist value adding process.

The recent debate in France focuses more on the potential effects of VC firms on underpricing than on the economic performance of the companies that are financed. Several studies test the certification and grandstanding hypotheses but only a few empirical works are interested in analyzing the impact of VC firms' involvement in the long-run economic performance of companies, or on firms' survival. Our aim in the present paper is to respond to the following research questions: *When* do VC firms add value to French IPO firms? And equivalently, *when* does the monitoring role of VC firms really become effective for improving firm survival? We focus here on the impact of VC firms on the survival of IPO companies in France. We argue that the involvement of venture capitalists needs to be considered through a more refined examination of venture capitalists' investments rather than considering VC financing as homogeneous financing which is only marginally informative. Indeed, even among VC firms there is likely to be wide variation in the quality and effectiveness of the monitoring and value added services they provide. Following Wang et al. (2003), we classify VC-backed firms according to VC investment duration proxied by stage of development. However, VC investment duration is expected to have opposing effects on firms' economic performance.

We present these potential effects by analyzing three type of VC investment duration corresponding *de facto* to three types of development stages: the shortest, which corresponds to later stage or bridge stage investment; the longest, which corresponds to early stage investment; and the intermediate, which corresponds to expansion stage investment. Rather than the classification chose by Wang et al. (2003), VC-backed IPOs are categorized according to two VC durations (long and short); we chose to match VC investment duration

with stage of development financed. This classification allows us to analyze more precisely the potential opposing effects for each development stage/VC duration.

First, like Wang et al. (2003), we argue that the longer the VC participation, the greater the venture capitalist's ability to monitor and add value to the IPO company. For Jain and Kini (1995), the length of VC participation is a proxy for the quality of venture capitalist's monitoring. Therefore, the monitoring effect of venture capitalists will be stronger for longer VC investment duration. Cumming and Johan (2010) also explain that the certification role of VC firms should be more effective if VC firms have been involved in the company for many years. According to Cumming and MacIntosh (2001, p. 450), « […] the longer the duration, the greater the value of the certification effect ». We can argue that longer VC participation will lead to a more positive impact on the company's economic performance or equivalently on its survival.
However, it is well known that early stage VC investments face greater information asymmetry. In that case, a negative effect of VC financing might be due to adverse selection. VC firms may be denied the opportunity to invest in the most promising companies. In a theoretical article, Amit et al. (1990) argue that US VC funds provided very low rates of return in the 1980s (the mean internal rate of return was less than 10% at the end of 1985) because there were opportunities only to fund less skilled entrepreneurs and less profitable ventures. As a result of the adverse selection problem associated with asymmetric information, only less able entrepreneurs (i.e. less profitable ventures) will choose to involve VC firms in their capital structures. Manigart et al. (2002), on the other hand, argue that the high rates of return imposed by venture capitalists make this source of finance very costly, and that the best projects will seek funding from other, less costly sources. As a consequence, only second best projects apply for VC funding. We can reasonably expect that early stage investments are more strongly influenced by adverse selection than later stage investments. It is difficult to select between these theoretical arguments, thus we propose that:

H1a: compared to non-VC-backed IPO, VC-backed IPO financed by long VC investment duration will show superior economic performance.

H1b: compared to non-VC-backed IPO, VC-backed IPO financed by long VC investment duration will show inferior economic performance.

Turning to the effect of short investment duration, we can also identify opposing effects. First, we can argue that the shorter the VC participation, the less the VC ability to monitor and add value to the IPO company. Exerting effort is costly; therefore, a VC firm that wants to create larger added value through its management support needs a long-term relationship with its portfolio company (Tykvová, 2006). Short investment duration, then, may reveal the VC firm's decision to take advantage of the market and invest before rapidly exiting (Cumming and Johan, 2010). « If - in an extreme case - a private equity investor offers only money and no management support, it may invest in the firm to park its money and resell the firm very fast » (Tykvová, 2006, p. 403). In that case, VC firms engage in grandstanding. If VC firms do not offer monitoring services and other value enhancing activities but create other conflicts

or engage in grandstanding, the performance of short term VC-backed firms will be worse than that of non-VC-backed firms.
However, investing in later stage development should offset the negative effect due to adverse selection. Indeed, later stage investments face less information asymmetry than early stage investments because firms have already developed and begun to market their products in this stage of development. Furthermore, in France, VC firms are usually specialized in later-stage development. According to De Clercq et al. (2001), a specialist expertise allows for a better understanding of the complexities associated with a particular development stage. The accumulation of knowledge over a specific development stage can be used to manage similar investments more effectively. Thus, one can expect relatively higher certification effects of VC investment in later stage development in France, or at least a sharp decrease in adverse selection. In that case, we would expect that the performance of short VC-backed IPOs to be better than that of non-VC-backed IPOs. As before, we suggest two opposing hypotheses:

H2a: compared to non-VC-backed IPO, VC-backed IPO financed by short VC investment duration will show inferior economic performance.

H2b: compared to non-VC-backed IPO, VC-backed IPO financed by short VC investment duration will show superior economic performance.

Turning to the effect of intermediate investment duration (between shortest and longest VC investment duration), it is more difficult to produce the opposing effects and to select between these conflicting theoretical arguments. First, the monitoring effect of venture capitalists will be stronger for this VC investment duration than for the shortest VC investment duration but less strong than for the longest one. Second, VC investments in the expansion stage face less information asymmetry than VC investments in the early development stage. Thus, we can reasonably expect that early stage investments are influenced more severely by adverse selection than expansion stage investments. Third, the danger of grandstanding should be less for intermediate VC duration than for the shortest duration. Therefore, we suggest that the performance of intermediate VC-backed IPOs will be better than that of non-VC-backed IPOs. Hence, we propose:

H3: *compared to non-VC-backed IPO, VC-backed IPO financed by intermediate VC investment duration will show superior economic performance.*

3. DATA AND METHODOLOGY

Our sample includes French IPOs that were floated on the main and secondary tier markets over the period 1996-2006[2]. Our primary list of IPOs was obtained from the *Euronext* files. These files contain information such as first-day closing price, money raised at the IPO, issue

[2] We excluded firms issued on the *Premier Marché* in order to avoid too large dispersion in the sample. These firms are among the largest, and have higher market capitalization than firms in other markets due to higher listing and disclosure requirements than in other markets.

proceeds, etc. Additional data are from *Autorité des Marchés Financiers* (AMF) publications which contain company listing prospectuses and annual reports. We use these prospectuses and annual reports to derive quantitative information on several financial and business variables. We also collected data for post-IPO years from companies' annual reports; where annual reports were not available, we obtained data from the DIANE (Van Dijk) database. Similar to the methodologies used by Chahine et al. (2007) and Coakley et al. (2007), from the original list of more than 600 IPOs in the period 1996–2006 we excluded: investment trusts, financial companies, building societies, transfers from other stock markets or market tiers, foreign-incorporated companies, registrations at the time of a relisting following temporary suspension of a firm. We also excluded all IPOs that represented de-mergers or equity reorganizations. As a result of this selection, the final sample includes 215 entrepreneurial IPOs in France for which we have all the information required for the study.

We use a survival analysis methodology to analyze the impact of involvement of VC in firm's survival. Survival analysis has been applied to business to analyze the economic performance of new-technology based firms (Storey and Tether, 1998). The advantage of survival analysis is that it overcomes the problem of inadvertent survivorship bias. Survival analysis allows us to account for the most promising and the least promising firms, with very high or very low economic performance. Unlike logit or probit models, survival analysis allows us to assess the conditional probability of failure given that the company has survived so far. Thus, survival analysis can cope with right censored data which represents situations where a failure event has not yet occurred, and with time-series data with different time horizons (Jenkins, 2005). The IPO market we study is characterized by both situations (Jain and Kini, 2000). The data are right censored, since at any point in time a proportion of the companies that went public are still listed. Further, the time window is different for each firm depending on when in the sample period it went public: in our sample, firms went public between 1996 and 2006. Finally, survival analysis allows us to apply a competing risk model to account for heterogeneity in firm exit. While the literature identifies survival as indicative of positive performance, and firm exit as representing negative performance (Caves, 1998), the mode of exit also needs to be considered. We consider here that different from an event of liquidation, involvement in a merger or acquisition might well be positive.
IPOs are tracked up to December 2012 to determine whether or not they were delisted. The date of delisting and mode of exit were collected from official reports available on the NYSE Euronext website and the economic newspaper *Les Echos*. In line with Jain and Kini (2000) and Espenlaub et al. (2012), we define survivors as firms that continue to operate independently as public corporations. Thus, firms delisted from the markets due to failure or an acquisition or merger are classified as non-survivors. We excluded three firms delisted due to voluntary delisting, leaving a sample of 212 IPOs. In this paper, we relax the assumption of homogeneous exit by accounting for mode of exit, namely firm liquidation or firm acquisition/merger. According to Schary (1991), there are important economic differences between the forms of exit, and when studying firm survival, we need to consider and separate exit types. Following Manigart et al. (2002) and Cockburn and Wagner (2010), we consider that involvement in a merger or acquisition may be positive.

We focus on firm survival time through a duration variable[3]. Let *T* be the number of years that our companies have survived up to 2012. A basic concept for the analysis of survival times is the hazard function *h(t)* which is defined as the limit. It is the conditional failure rate defined as the probability of exit during a very short time interval assuming the firm has survived to the beginning of that interval. The hazard function is defined as the probability density function and the cumulative distribution function. The hazard function is given by:

$$h(t) = \frac{f(t)}{S(t)} = \lim_{\Delta t \to 0} \frac{\Pr(t < T \leq t + \Delta t | T > t)}{\Delta t}$$

where Δt is a very short time interval. This conditional probability is the probability that exit occurs in the time interval $[t\ ;\ t + \Delta t]$, based on no exit before the beginning of time *t*.

Like Hensler et al. (1997), Jain and Kini (2000), and Espenlaub et al. (2012), we estimate a survival model known as the Accelerated Failure Time (AFT) model. The advantage of the AFT model is that it allows the impact of the independent variables on survival time to vary over the post-IPO period depending on the length of time since listing (Jain and Kini, 2000; Espenlaud et al., 2012). For instance, Jain and Kini (2000, p. 1156), explain that «[…] it is quite reasonable to expect that the impact of VC involvement on survival may be greater for IPO firms that have recently gone public compared to those that have a longer history as a public company». The AFT model is parametric making it necessary to specify the distribution of the baseline survival function (Jenkins, 2005). In line with Cleves et al. (2004), we use likelihood or Wald tests and the Akaike Information Criterion (AIC) test to select a respectively nested and non-nested parametric model[4]. The AIC test shows that for our model, the log-normal distribution has a lower AIC value than other distributions, and hence we select the log-normal distribution.

Survival methods can be extended to the analysis of situations where there are different exit routes, namely, bankruptcy or voluntary liquidation, and merger/acquisition. We then relax the assumption of homogeneous exit by accounting for mode of exit in order to examine whether the determinants of exit differ depending on the exit route. We compute a competing risk model (CMR) which is an extension of a standard duration model with the possibility of exit to one of several destination states (Jenkins, 2005). This model requires only that competing risks are mutually exclusive and exhaustive (i.e., a firm cannot exit through simultaneous liquidation and acquisition/merger) (Estève-Perez et al., 2010). We therefore report estimation results for both a pooled model that does not distinguish between different modes of exit, and a competing risks model that takes explicit account of the different exit routes.

[3] These explanations are based on Jenkins (2005).
[4] For more information, see Cleves et al. (2004) or Jenkins (2005).

As a robustness check, and to enable comparison with other studies, in addition to the AFT model we estimate the Cox proportional hazard (PH) model[5]. We estimate the Cox PH model (a semi-parametric model) for both the pooled model which does not distinguish between different modes of exit, and for the competing risk model[6]. The Cox PH model makes no assumptions about failure distribution (Jenkins, 2005). However, the interpretation of the results is quite different for the AFT model and the well-known Cox proportional hazard model (PH model). The AFT regression coefficient relates proportionate changes in survival time to a unit change in a given regressor, all other characteristics being held fixed. Interpretation of the coefficients of the PH model is different: they relate a one unit change in a regressor to a proportionate change in the hazard rate not the survival time (Jenkins, 2005). The Cox PH model requires the hazard of the independent variables to be proportional, such that changes in the level of an independent variable are assumed to produce proportionate changes in the hazard function, independent of time (Jenkins, 2005). We tested the proportionality assumption specifications based on Schoenfeld residuals of the Cox regressions (Cleves et al., 2004); the results show that this model is not particularly well suited to our data.

According to Cleves et al. (2004) and Jenkins (2005), AFT models typically follow the parameterization:

$$\ln(t_j) = x_j\beta_x + \epsilon_j$$

Specifically, we estimate the following model:

$$\begin{aligned}\ln(t_j) = \beta_0 + \ & \beta_1 VCEarly + \beta_2 VCExpansion + \beta_3 VCBridge + \beta_4 Age + \beta_5 Age2 \\ & + \beta_6 \ln(size) + \beta_7 Growth\ Rate + \beta_8\ Investment\ Bank\ Reputation \\ & + \beta_9 Insider\ Ownership + \beta_{10}\text{Intangibles Ratio} + \beta_{11}\ln(patent) \\ & + Year\ Dummies + Industry\ Dummies + \epsilon_j\end{aligned}$$

where $\ln(t_j)$ is time to failure, which is measured (in years) as the time interval from IPO date to delisting date. Survival time is the period between 1996 (year of first listing in the sample) and the year that the company exited as a result of liquidation or merger/acquisition. Survival time is right censored to 2012 since for continuing firms we do not have a recorded exit event. The independent variables are defined as follows.

Age is calculated as the difference (in years) between the founding date of the company and the date of its IPO. Bearing in mind evidence that the link between age and survival may follow an inverted U-pattern (Evans, 1987), we also enter in the model the squared term of age: *Age2* (Evans, 1987; Cefis and Marsili, 2005).

[5] We also tested the model with other distribution of the baseline survival function as a robustness check.
[6] A formal test of whether exits to different states are behaviorally distinct is presented in Appendix B.

Ln(size) is the natural logarithm of the market capitalization of the IPO firm at the IPO price (expressed in euros). Similar to Coakley et al. (2007), this variable controls for size.
Similar to Audretsch and Lehmann (2004), *Growth Rate* is the difference in the number of the firm's employees at the time of IPO, and one year after the IPO (measured as the difference in the natural logarithm).
Investment Bank Reputation is a dummy variable used to control for lead underwriter reputation. Indeed, Carter et al. (1998) show that IPOs managed by more reputable underwriters are associated with less short-run underpricing, and Jain and Kini (2000) argue that reputable investment banks enhance IPOs survival. Following the methodology in Broye and Schatt (2003) for the French case, we distinguish two groups of investment banks - reputable investment banks and non-reputable investment banks - according to the number of participations in IPOs during the period of analysis (1996-2006), in each year. We consider that an investment bank is reputable if it has participated in a number of IPOs above the median value. The variable *Investment Bank Reputation* is a dummy that takes the value 1 if the IPO is backed by a reputable lead investment bank and 0 otherwise.
The financial literature shows that the ownership structure can have an influence on corporate performance. This influence is not necessarily positive. For instance, McConnell and Servaes (1990) show that the relation between ownership structure and performance should be considered non-linear, confirmed by Séverin (2001) for the French case. However, according to Jain and Kini (1994) managerial ownership retention has a positive impact on post-IPO performance and enhances IPO survival (Jain and Kini, 2000). A similar result was obtained by Hensler et al. (1997) which considers the impact of the percentage of shares held by insiders on firm survival. Similar to Hensler et al. (1997), Séverin (2001), and Espenlaub et al. (2012), we define the variable *Insider Ownership* as ownership (percentages) by members of Board of Directors (BOD) at the time of IPO[7].
We include two independent variables *Ln(patent)* and *Intangibles Ratio* to account for some of the firm's intangible assets. Based on the types of companies listed on the financial market during the period 1996-2006, and the number of firms (70% of our sample) listed on "Nouveau Marché" and Alternext, the potential for innovation of these companies would seem important. Indeed, Baum and Silverman (2004) and Villalonga (2004) highlight the strategic role of innovation in business survival. The variable *Ln(patent)* is defined as the natural logarithm of the number of patents owned by the company at the time of IPO[8]. Due to the limited availability of accounting data and especially R&D expenses, we calculate the ratio of intangible assets to total assets to account for the nature of the assets (Hasan and Wang, 2008) and the proportion of intangible assets owned by the company (Villalonga, 2004)[9]. The variable *Intangibles Ratio* is the capitalized amount of intangible assets divided by total assets[10].

[7] Following the methodology in Khurshed et al. (2005), this measure of ownership includes ownership by BOD members *via* corporate vehicles.
[8] This variable should be interpreted with caution because some of the companies in our sample were not able to protect their innovations by patents at the time of IPO. In contrast to the US system, the EU and especially the French legal system do not allow firms (easily) to obtain patents on software.
[9] Bottazzi and Da Rin (2002) collected data on R&D expenditure for a set of 5 new European markets. They explain that their sample of firms was reduced almost 50% due to lack of data on R&D expenditure.
[10] It should be noted that the correlation matrix does not show a significant correlation between *Ln(patent)* and *Intangibles Ratio*.

Our main interest in this study is the impact of VC involvement on firm survival. Similar to Jain and Kini (2000), we define the independent variable *Venture Capital* as a dummy variable that takes the value 1 if the IPO firm was VC backed before the date of the IPO and zero otherwise. We identified VC firms from various sources: European Venture Capital Association (EVCA), *Association Française des Investisseurs pour la Croissance* (AFIC - the French equivalent of EVCA), venture capitalists' websites, and *Les Echos*.

In a second step, we use four more proxies for VC involvement and monitoring to test our hypotheses. The variable *VC Number* is derived from Lerner (1994), Jain and Kini (1995), and Dimov and De Clercq (2006). *VC Number* is defined as the number of venture capitalists holding equity stakes at the time of the IPO[11]. This variable takes account of the quality of VC monitoring. We include three more dummy variables to account for length of the venture capitalist's investment period. As already explained, the duration of venture capitalist investment is proxied by the development stage of the company. A VC firm investing in the first development stage (seed/start-up stage) will participate for longer than a venture capitalist investing in a later development stage (e.g. bridge stage). Similar to the classification in Tykvová (2006), the variable *VCEarly* is a dummy that equals 1 if the company received its first equity financing during the two years previous to the company's establishment (start-up/seed financing). The variable *VCBridge* takes the value 1 if the firm received its first equity financing during the 12 months prior to the IPO (bridge financing). The variable *VCExpansion* (expansion stage) is a dummy that equals 1 if the firm received its first equity financing neither in the start-up/seed stage nor in the bridge stage. VC firms that invest in the early stage, retain their equity shares for around five years. Investment in the expansion stage means they retain their equity share for around four while bridge stage investment involves only one year of equity share on average. The respective median values are 4 years, 3 years and 1 year[12]. Further tests using a Cox PH model (not presented here but available on request), confirmed that VC firms participate for longer duration if they invest in the early stage compared to bridge or expansion stage.

Finally, in order to control for differences in technology sectors, and their influence on the survival rates of firms, we include aggregated industry dummy variables for six industry sectors, based on the Euronext classification and the APE codes (French company sectoral classification codes). We defined six dummy variables for the following sectors: *ITS* (comprising Internet, IT services, E-commerce and software), *Life Sciences* (comprising biomedical and pharmaceutical sectors), *Media* (Media & Entertainment), *Telecom*, *NHT* (Non High Tech products and service), and *Other* (other high-technology and electronics products and services).

The findings in Coakley *et al*. (2007) show that post-issue operating performance of IPOs concentrated in the 1998–2000 bubble years, declines sharply, while IPOs perform normally in the remaining years. They indicate that poor quality IPOs were taken public during the bubble period. This period could lead to some overestimation of the lower survival of IPO firms in our sample. To control for time effects, we include IPO date as a dummy variable for

[11] The number of venture capitalists is strongly correlated with the aggregate equity stake of venture capitalists.

[12] For a comparison of VC investment durations when firms are financed by venture capitalists in the early, expansion and bridge stage, see Appendix A, Table 8.

the years 1998, 1999, and 2000. These three dummies allow us to take account of the hot market issue period and its possible impact on firm survival.

4. RESULTS

(i) Descriptive statistics and survival times

Table 1 provides descriptive statistics for the whole sample and for the samples of VC and non-VC-backed IPOs. The average firm age and size of IPO firms in our main sample are 10.29 years and 68.31 million euros, respectively. VC-backed firms are relatively larger than non-VC-backed firms (41.42 and 87.03 million euros respectively). Perhaps the most surprising result is for the variable *Investment Bank Reputation*. It seems that venture capitalists in France are unable to attract the most prestigious underwriters (significant difference at the 0.1% level). The results obtained by Rindermann (2003) for the period 1996-1999 confirm this: venture capitalists in France do not play a role in certification for IPO. IPO firms show relatively high levels of insider ownership, with mean ownership at around 75%; non-VC-backed firms show significantly (at the 0.1% level) higher levels of insider ownership than VC-backed companies (86.65% and 66.65% respectively). This may reflect the fact that insiders have to relinquish a part of their equity stake in favor of venture capitalists (Kaplan and Strömberg, 2003) who may not be board members (in our sample, in around 60% of cases venture capitalists are not board members at the time of the IPO). Table 1 shows also that for VC-backed firms the number of patents is higher than for non-VC-backed firms although, we cannot identify the direction of the causality. VC funding may have an impact on the number of patented innovations (Kortum and Lerner, 2000) but patents might act to signal the good quality of the firm's innovations which might attract VC financing. For the other control variables, we do not observe significant difference between years and sectors. VC-backed firms are not especially concentrated in a sector compared to non-VC-backed firms, and all firms are more likely to belong to the *ITS* sector.

[Insert table 1]

Table 2 compares the descriptive statistics for the subsamples of companies that continued to be listed until the end of our study period at December 2012 (survivors), and those companies that had been delisted by December 2012 due to a merger/acquisition or liquidation (non-survivors). Table 2 shows significant differences between listed and delisted IPO firms. In terms of the characteristics of IPO firms, the results show that surviving companies are older, are larger in size, and have higher growth rates than non-survivors.

It is interesting that delisted firms have higher insider ownership than surviving firms. This contrasts with the result in Jain and Kini (2000); however the different modes of firm exit may help to explain this result. Our intuition about number of patents held by companies is confirmed: surviving firms have a bigger number of patents than delisted firms.

However, the results for our main variables related to VC financing are less conclusive: we do not observe significant differences between firms. In our views, this may be the result of non-discrimination between merger/acquisition and liquidation events.

As noted previously, most companies in our sample were listed during the bubble period but non-surviving firms seem to be concentrated in year 1998 and years 1999 and 2000 show no significant differences. In terms of sectoral variables, we do not observe any significant differences.

[Insert table 2]

Table 3 summarizes the dependent variable of our multivariate analyses (the time between the firm's IPO and its delisting) within the groups of VC and non-VC-backed firms but also within the groups of firms financed by venture capitalists in their early, expansion and bridge stage of development. Comparing the average duration of VC and non-VC-backed firms; we find that VC financing is associated with shorter survival times. We also find that IPOs financed by VC firms in the later stage of development are associated with shorter survival times than other IPOs.

[Inset table 3]

(ii) Multivariate survival analysis: competing risk model

The results of our pooled model (which does not distinguish between exit routes) hide some interesting differences related to types of exit. The results of the competing risks model, which distinguishes between delisting due to a firm merger or acquisition, and delisting due to business failure, are more revealing. Table 4 column (1) presents the estimation results for the pooled model, while columns (2) and (3) present the results for the competing risks model which distinguishes between exits due to merger/acquisition and delisting due to business failure. In general, we consider that involvement in a merger or acquisition may well be positive for the firm in contrast to liquidation. However, if bankruptcy can be interpreted as failure, being bought might be more ambiguous: on the one hand, a firm may represent a valuable investment for another firm, because its business is profitable. On the other hand, a non-profitable firm facing bankruptcy might be bought in order to acquire its assets not because of its operations (Cockburn and Wagner, 2010). To try to mitigate this ambiguous effect, we classify firms closed due to bankruptcy and bought by other firms as being involved in a liquidation event[13].

As noted above, for the AFT model, we choose the log-normal distribution as the baseline survival function based on the AIC test. As a robustness check, we also estimate the Cox PH model. Note, however, that interpretation of the coefficients is different for the Cox PH and AFT models. While the dependent variable in the Cox model measures risk of failure, in the AFT model it measures survival time. We report both the coefficient and the time ratio for the independent variables of the AFT model in Table 4 and we report both the coefficient and hazard ratio for the independent variables of the Cox PH model in Table 6. In the AFT model, a positive coefficient implies a time ratio greater than 1, which indicates that an increase in

[13] Some firms are likely to be acquired as a result of financial difficulty or poor performance. However, due to the difficulty involved in obtaining identical performance measures for all firms prior to their delisting, we cannot classify firms using a similar methodology to that employed by Jain and Kini (2000) or Espenlaub et al. (2012). Instead, we use the specification in Fontana and Nesta (2009), Cockburn and Wagner (2010) and Esteve-Perez et al. (2010).

the covariate increases survival time (or equivalently, slows down failure). In the Cox PH model, a positive coefficient implies a hazard ratio greater than 1, which indicates that an increase in the covariate increases failure rate (or equivalently, decreases expected duration).

[Insert table 4]

Table 4 shows that *Age* and *Size* of companies have no effect on firm survival while the variable *Age2* (squared value of age) has a negative and significant coefficient indicating that exits occur mainly among "middle-aged" firms. The result for the effect of *Age* is clearly different in the competing risk model. *Age* has a positive and significant coefficient for firms delisted due to business failure indicating that younger firms show lower survival times when considering exit due to liquidation, and no effect on time to delisting through a merger/acquisition. This result is consistent with the results in several empirical studies notably in Cockburn and Wagner (2010) and Esteve-Perez et al. (2010). Firm growth rate has a positive impact on firm survival time in columns (1) and (2). In column (1), a one-unit increase in *Growth Rate* increases survival time by between 51% and 52%. The estimated effect of firm's *Growth Rate* is positive and significant for firms that merged or were acquired following their IPO suggesting that firms that grow faster are likely to be acquired or merged less immediately (survival time increases by 62%). However, this variable has no effect on survival time when we consider exit via liquidation.

Insider Ownership has a negative effect on survival time. This variable has a quite small impact on survival time which decreases by 7% for a one unit increase of *Insider Ownership*. Ownership by board members at the time of the IPO is significant for explaining exit via liquidation. The negative coefficient indicates that increasing ownership by insiders speeds time to delisting due to business failure but only slightly (survival time decreases by 1 percentage point). The impact of this variable is surprising but seems to support the results obtained by Serve (2007) for the French "Nouveau Marché", that IPO firms with high levels of managerial ownership retention show faster decline in post-issue operating performance than firms with lower levels of managerial ownership retention. Our result is in line with the entrenchment hypothesis developed by Shleifer and Vishny (1989). The absence of a significant effect on delisting via merger/acquisition, in our view, is quite surprising: concentration of ownership known to be an anti-OPA mechanism, should significantly diminish the probability of exit via merger/acquisition but in our sample, we do not obtain this kind of result.

Turning to the effect of share of intangible assets in total assets, there are very substantial differences in the time ratios for different modes of exit. The effect of *Intangibles Ratio* is not statistically significant in the pooled risks specification, and the competing risks specification shows clearly that this result is due to two offsetting effects. *Intangibles Ratio* has a significant and negative coefficient (Table 4 column (2)) indicating that firms reporting higher shares of intangibles assets compared to total assets are likely to be acquired or merged earlier (survival time decreases by 84%) while the results are the opposite for exit via liquidation (with an effect of smaller magnitude). Firms with large stocks of intangibles may represent a threat but also may represent an opportunity for other firms to acquire valuable intangible capital and distinctive skills. So a high stock of intangible capital may be an asset that is

attractive to potential acquirers of the firm (Chaudhuri and Tabrizi, 1999). The variable *Ln(patent)* has a positive coefficient, suggesting that ownership of patents confers certain advantages on the firm that translate into higher survival time which increases by around 30% for a one unit increase in *Ln(patent)*. The results for this variable show also that firms with more patents are protected against merger/acquisition, while there is no significant effect for exit via liquidation. These results are in line mostly with those obtained by Cefis and Marsili (2005), Fontana et al. (2007), and Cockburn and Wagner (2010). These authors explain that this outcome may indicate the triggering of a merger/acquisition perhaps by business difficulties/distress may be significantly delayed by ownership of patents. However, these findings show that the merger/acquisition mechanism is complex, and that not all intangible assets provide the same competitive advantage or protection to firms. It should be noted also that a several firms in our sample belong to the Internet and software sectors, areas where French regulation makes it difficult for firms to obtain patents.

Investment Bank Reputation has no effect on firm survival whatever the model considered. Interestingly, the outcomes show that an IPO in the years 1998 and 2000 (for column (1)) significantly reduces survival time.

Turning to the effect of VC financing, very substantial differences are apparent in the time ratios for different modes of exit[14]. We are interesting in the impact of quality of VC monitoring on exit routes as well as VC ability to create additional value. To measure the impact of VC financing on firm survival, we employ several variables and models. We use four variables for VC involvement and monitoring, to test our hypotheses about the value adding process. In column (1), we find that firm survival time decreases as the number of venture capitalists involved in the financing increases. A one-unit increase in *VC Number*, decreases survival time by 8%. Number of VC firms, identified by Jain and Kini (1995) as a proxy for monitoring quality, does not show the expected result. However, in columns (2) and (3) we see that the negative coefficient in the pooled risks specification derives from the effect on exit via merger/acquisition. Firms financed by a large number of venture capitalists are more likely to be acquired within a short time or merged with another firm. The impact of *VC Number* is not negligible because survival time decreases by 10% with an increase of one-unit in the number of venture capitalists involved in the financing. This suggests that VC firms still involved in the company after the IPO may find attractive to sell their shares via a merger/acquisition because this type exit is also promising for VC firms (Giot and Schwienbacher, 2007). According to Jain and Kini (1995) and Wang et al. (2003) most venture capitalists continue to hold significant equity stakes for one or two years after the IPO, and the outcome obtained for this proxy for monitoring quality tends to support the hypothesis of value added. Moreover, in France venture capitalists are subject to a lock-up agreement at the time of the IPO and are forced to keep most of their equity stake for between

[14] Appendix C, table 9 shows the results for the AFT competing risk model when employing the binary variable *Venture Capital* in order to test the global impact of VC financing on firm survival time. In Table 9, *Venture Capital* has no significant effect (but with a p-value = 0.123) on survival time when considering the whole period of analysis. The negative sign on the coefficient indicates that VC-backed firms may display lower survival times than non-VC-backed firms. This result is consistent with that obtained by Audretsch and Lehmann (2004) for Germany, and by Espenlaub et al. (2012) for the UK but differs with Jain and Kini's (2000) and Cockburn and Wagner's (2010) results for the USA. However, this negative effect is due to the fact that there are some differences between the different types of exits; this dummy variable is only significant for exit via liquidation with a negative coefficient.

6 and 12 months after the IPO (Goergen et al., 2009). Also, the financial market in France is shallower and less liquid than the US and UK markets. So VC firms might find attractive to sell their shares through a merger/acquisition rather than reselling directly in the market. Lack of market liquidity is often highlighted as an obstacle to a more dynamic VC industry.
We find no significant effect for the variable *VCEarly* suggesting that the early stage VC investments face greater information asymmetry and thus are more severely influenced by adverse selection than other VC and non-VC investments. It is possible that the negative effect of adverse selection outweighs the positive effect of longer duration of VC investment but we find no direct support for this. Thus, we cannot confirm hypotheses H1a or H1b. The effect of *VCExpansion* is not statistically significant in the pooled risks model, but the competing risks specification clearly shows that this result is due to two offsetting effects. This variable shows a significant and positive coefficient (Table 4 column (2)) indicating that firms financed by VC during the expansion stage (2 years after firm foundation to at least 1 year before IPO) have longer survival times than other firms, and so are less likely to be acquired or merged in a short time. The time ratio for this variable is particularly high indicating a huge impact on firm survival time which increases by a multiple of 2.446. However, the opposite result is found for exit via liquidation (with a small effect i.e. significant at the 10% level - Table 4 column (3)) indicating that the firms financed by VC during this stage of development are also more likely to be liquidated very soon after the IPO. This result hides the different and significant effects of this type of financing on the two exit routes. We should bear in mind that stage of development is used here as a proxy for venture capitalists' investment duration since the earlier the finance is provided to the firm, the longer will be the investment duration. However, the results are determined by our choice of variables *VCEarly*, *VCExpansion* and *VCBridge*. If we follow the classification employed in Wang et al. (2003), we obtain rather different results. If like Wang et al. (2003) we consider that firms with less than two years of VC support before the IPO should be categorized as short VC-backed IPOs, we then have to reassign to the bridge stage some firms initially defined as financed in the expansion stage. If we assume this reclassification (see Table 7), the variable *VCExpansion* becomes insignificant (column (3)) with a single identical effect shown in column (2). These results provide support for our hypothesis H3 indicating that VC financing is involved in the value adding process if investment is in the expansion stage. Turning to the effect of *VCBridg*e, we find one main result: the negative and significant coefficient of this variable (column (3)) indicates that firms financed by VC during the later stage of development (with short duration VC investment) are more likely to suffer rapid liquidation (survival time decreases by 48%) than other firms. This outcome shows that VC firms are able to create additional value only if the investment is for a long period of time. Note also that in the additional specification described above, the variable *VCbridge* becomes significant in the pooled risks specification in Table 10 column (1) indicating a negative impact of this variable on firm survival time if exit is treat as a homogeneous event. These findings support our hypothesis H2a.

Our findings show that VC firms do not create additional value if they invest in later stages or equivalently if investment duration is too short (less than a minimum of 2 years) while longer investment duration allows venture capitalists to monitor the firm efficiently and to add some

value. However, the earliest stage of investment seem to be more prone to adverse selection. At the same time, the proxy for quality of VC monitoring shows a positive result. Therefore, it seems that need to consider several criteria to achieve a better understanding of the contribution of venture capitalists to improved firm performance. These results show that analyzing VC firms as a single group of investors is not sufficient to understand the role of the forces at play.

5. ADDITIONAL RESULTS: FURTHER TESTING ON PERIOD OF ANALYSIS AND ROBUSTNESS RESULTS

(i) Period of analysis: bubble versus normal period

We provide two types of additional tests concerning our results.
Firstly, following Wang et al. (2003) and Coakley et al. (2007), we separate our sample into two periods: normal (1996-1997/2001-2006), and bubble (1998-2000). Indeed, Coakley et al. (2007) show that poor quality companies - both VC and non-VC-backed - are taken public during bubble periods resulting in considerably decreased operating performance. The bubble period can lead to overestimates of the negative impact of VC financing on firm performance. Thus, considering both sample periods should offer some contrasting results concerning the impact of VC involvement on firm survival.
Models in Table 5 treat observations delisted due to both merger/acquisition and liquidation as failures, and report the results separately for the normal and bubble periods[15]. We first summarize the results for the normal years (1996-1997 and 2001-2006) for our sample using specifications 3 and 4. Based on the results in Coakley et al. (2007) for UK IPOs, we conjecture that the impact of VC financing on firm survival is not identical for the two periods of analysis.
The coefficient of the *Investment Bank Reputation* is positive and significant at the 1% level which contrasts with the finding for the full sample. This suggests that during the normal period, by choosing a reputable underwriter, the IPO firm can increase its survival time. This finding is consistent with the result in Espenlaub et al. (2012) for the UK AIM market. The coefficient of the ratio of intangible assets is significant with a negative sign indicating that firm survival time decreases as the ratio of intangible assets increases. This result has been explained by the different modes of firm exit considered. The coefficients of the *Ln(patent)*, *Growth Rate*, *Insider Ownership* and *VCExpansion* are unchanged. The variable *Venture Capital* has no significant effect on firm survival time while the variable *VC Number* has a negative and significant (only at the 10% level) effect on firm survival time. However, in model 4, the variable *VCEarly* now shows a positive and significant coefficient, indicating that duration of VC involvement/monitoring has a positive effect on firm survival time. This variable effect predominates in the ratio with value (2.669): being financed by venture capitalists in the early stage of development increases survival time by a multiple of 2.669

[15] It should be noted that due to the number of observations, we cannot split our sample into two sub-periods when considering the different modes of firm exit.

compared to other firms. This finding, which reinforces our previous results, is in line with the idea that the longer the duration of VC investment the larger the additional value created by venture capitalists. Also, this result mitigates the absence of a significant effect of this dummy variable in the pooled model in Table 4. The positive aspect linked to longer duration of VC investment seems to outweigh the negative effect due to adverse selection *only* during the period of normal activity.

Interestingly, the results for the 1998-2000 bubble years show differences (models 1 and 2). Some variables and some models lose significance. The variable *Investment Bank Reputation* becomes insignificant. In model 1, we find that *Venture Capital* has a significant and negative coefficient indicating that VC-backed firms have shorter survival times than non-VC-backed firms. Receiving VC financing reduces firm survival time by 52% during the bubble period. These results are in line with those obtained by Coakley et al. (2007) for the UK, which do not support screening activities by reputable sponsors (venture capitalists and underwriters) in the bubble period. At the same time, our results for this time period support the idea of a conjunction between the phenomena of adverse selection and grandstanding. According to Wang et al. (2003), the grandstanding effect may magnify the effect of adverse selection since premature IPO would expose the listed company to a higher business risk and in our case result in shorter survival time. Finally, the impact of VC involvement on firm survival time seems to be mitigated depending on the period of analysis and the duration of investment (stage of development) considered. The inclusion of the bubble period seems to neutralize the positive impact of receiving very long duration investment from venture capitalists (proxied by *VCEarly*) whereas the impact of the dummy *VCBridge* (short duration investment) seems to be magnified by the bubble period (with perhaps a greater grandstanding effect) although the evidence is not conclusive. We assume that even if the inclusion of bubble period can lead to underestimates of the positive impact of receiving VC financing in early stage (for very long duration), it does not challenge our main findings.

[Insert table 5]

(ii) Robustness of results

As a robustness check, we re-estimate our results using the Cox PH model. Table 6 reports the results of the Cox PH model and shows that our results are qualitatively unchanged (with the exception of a slight reduction in the statistical significance of the coefficients of some variables). Table 6 column (1) provides estimation results of the pooled model; columns (2) and (3) present the results for the competing risks model which distinguishes between exits due to firm merger/acquisition and delistings due to business failure.

As already explained, this type of model requires only that competing risks are mutually exclusive and exhaustive (i.e., a firm cannot exit simultaneously through liquidation and acquisition/merger)[16] (Estève-Perez et al., 2010). Narendranathan and Stewart (1991) provide a test for whether exit routes are independent, i.e. whether exit to a different state is behaviorally distinct (rather than simply incidental) in continuous time proportional hazards

[16] See Appendix B.

(PH) models (Jenkins, 2005). Therefore, we conducted proportionality of risks tests proposed by Narendranathan and Stewart (1991) and explained in Appendix B. We reject (at the 1% statistical significance level) the null hypothesis that different forms of exit are behaviorally equal (TS = 154). We also investigated alternative distributions as the baseline survival function for the AFT model which suggests that our findings (not reported here) are mostly robust.
The Cox PH specification corresponding to the model for normal (1998-2000) and hot (1996-1997 and 2001-2006) markets, and single exit, are available on request; the results are similar to the results of the AFT model (Table 5).

[Insert table 6]

Finally, we examine alternative measure for the variables *VCExpansion* and *VCBridge*. As already explained, if we follow the classification in Wang et al. (2003) and categorize firms with less than two years of VC support before the IPO as short VC-backed IPOs and reclassify the bridge stage, then our main results remain unchanged but are slightly modified for the impact of *VCExpansion* and *VCBridge*. Thus, our main conclusions are confirmed. Table 7 reports the results for this alternative specification (AFT specification).

[Insert table 7]

6. SUMMARY AND CONCLUSION

This paper examined the survival of a unique sample of 125 VC-backed and 87 non-VC-backed French IPOs over the 1996-2006 period. We estimate an Accelerated Failure Time (AFT) model and present the results of a survival analysis based on pooled data, and the results of competing risk specifications, comparing the survival times of VC and non-VC-backed firms. When controlling for a broad range of other known determinants of survival times, we find that VC firms cannot be treated as a homogeneous group of investors to analyze their impact on firm survival. Indeed, closer analysis reveals that the capacity for VC to add value to portfolio companies and to improve their survival time depends, among other elements, on VC investment duration.
Our findings show that VC firms do not create additional value if the investment is in later stages or equivalently if investment duration is too short (less than a minimum of 2 years) while longer investment duration allows venture capitalists to monitor firms efficiently and to add some value. However, for the whole sample period, the investment in the earliest stages (or equivalently longest VC duration investment) seems to be more prone to adverse selection. One interesting result emerges if we split the sample into two sub-periods of analysis: normal and bubble activity. Our findings show that during normal periods of activity, the longer the duration of VC involvement/monitoring the greater will be the positive effect on firm survival time. This positive impact disappears completely for the bubble period. The positive aspects linked to longer duration of VC investment seem to outweigh the negative effects of adverse selection *only* during normal periods of activity.

Our findings have implications for the French VC industry. Our results do not indicate that VC companies generally make a positive contribution to the survival of their investee companies. However, VC firms are able to add value to portfolio companies if the investment is for a longer time period, and is in the early and expansion stages of firm development. Thus, in France we need to encourage this type of VC investment rather than later stage investments in which the French VC industry is specialized at the moment.

Our findings also have implications for entrepreneurs. When analyzing the advantages and disadvantages linked to the presence of VC firms in the capital of their company, entrepreneurs should consider that certain types of venture capitalists may be more or less involved in the value adding process.

This study has some limitations. First, the bubble period 1998-2000 is included in our period of analysis and may lead to some overestimation of the poor survival of VC-backed IPOs. However, in our view, our main results are not skewed by the inclusion of this bubble period. Second, our analysis includes only French IPOs and it would be interesting to compare these results for France with findings for Germany and the UK.

Appendix A

Table 8: Duration of VC investment for VC-backed IPOs

Duration of VC investment (years)					
Variables	N	Mean	Median	p-value t-test	p-value Mann-Whitney-Wilcoxon test
VCEarly	47	4.97	4.00	0.0000	0.0000
VCExpansion	41	3.95	3.00	0.2490	0.0040
VCBridge	35	1.00	1.00	0.0000	0.0000
VCEarly versus VCExpansion				0.1218	0.1381
VCExpansion versus VCBridge				0.0000	0.0000
VCEarly versus VCBridge				0.0000	0.0000

First, we conduct a standard two-sided *t* test to test for differences in means between two subgroups type: for example *VCEarly* and the rest. In addition, we use the Wilcoxon–Mann–Whitney test to analyze the equality of medians. Second, we conduct a standard two-sided *t* (Wilcoxon–Mann–Whitney) test to test for differences in means(medians) between subgroups: for example *VCEarly versus VCExpansion* with *VCBridge* excluded. Variables are defined in Section 2. Note that for 2 VC firms, we do not have the exact date of VC investment. The duration of VC investment is defined as the difference (in years) between the date of first VC investment and the date of IPO.

Appendix B

Narendranathan and Stewart (1991) provide a test for whether exit routes are independent, i.e. whether exit to different states is behaviorally distinct (rather than incidental) for continuous time proportional hazard (PH) models (Jenkins, 2005).

This tests the hypothesis that cause-specific hazards are all proportional (i.e. that all parameters except the intercepts are equal across hazards) (Narendranathan and Stewart, 1991). The test statistic TS proposed by Narendranathan and Stewart (1991) is given by:

$$TS = 2[\ln(L_{CR}) - \ln(L_{SR}) - \sum_j n_j \ln(p_j)]$$

where $\ln(L_{CR})$ is the maximized log-likelihood from the competing risks model (the sum of those from the component risk model i.e. merger/acquisition and liquidation), $\ln(L_{SR})$ is the maximized log-likelihood from the single-risk model, n_j is the number of exits to state j and $p_j = {n_j}/{\sum_j n_j}$ where there are j = 1, . . . , J destination states (i.e. two destination states here).

The test-statistic is distributed Chi-squared with degrees of freedom equal to the number of restrictions (Jenkins, 2005).

Appendix C

Table 9: Competing and single risk estimates (AFT model) with VC as a single dummy variable

VARIABLES	(1) All Exit Coeff	(1) All Exit TR	(2) M&A Coeff	(2) M&A TR	(3) Liquidation Coeff	(3) Liquidation TR
Age	0.033[a]	1.034	-0.027	0.974	0.086***	1.090
	[0.021]		[0.042]		[0.032]	
Age2	-0.001**	0.999	0.001	1.001	-0.002***	0.998
	[0.000]		[0.001]		[0.001]	
Ln(size)	0.065	1.067	0.021	1.021	0.050	1.051
	[0.069]		[0.083]		[0.089]	
Growth Rate	0.421**	1.523	0.589**	1.802	0.171	1.187
	[0.204]		[0.251]		[0.270]	
Investment Bank Reputation	0.214	1.238	0.156	1.169	0.212	1.236
	[0.154]		[0.217]		[0.183]	
Insider Ownership(%)	-0.007**	0.993	-0.002	0.998	-0.012***	0.988
	[0.003]		[0.004]		[0.004]	
Venture Capital	-0.279[b]	0.757	-0.047	0.954	-0.668***	0.513
	[0.181]		[0.240]		[0.232]	
Intangibles Ratio	-0.712	0.491	-1.704***	0.182	1.550*	4.711
	[0.471]		[0.510]		[0.817]	
Ln(patent)	0.302**	1.352	0.629***	1.876	0.053	1.055
	[0.128]		[0.230]		[0.146]	
Year 1998	-0.421**	0.656	-0.225	0.798	-0.617**	0.539
	[0.207]		[0.272]		[0.254]	
Year 1999	-0.173	0.841	-0.134	0.874	0.000	1.000
	[0.234]		[0.298]		[0.282]	
Year 2000	-0.459*	0.632	-0.559*	0.572	-0.132	0.877
	[0.245]		[0.328]		[0.318]	
Constant	4.298***		4.622***		9.840***	
	[1.279]		[1.413]		[1.597]	
Observations	212	212	212	212	212	212
Nb Exits	80	80	47	47	33	33
Log Likelihood	-165.507	-165.507	-116.667	-116.667	-80.507	-80.507
Wald Chi square	49.24***		38.06***		195.03***	

Notes : ***, **, * significant at the 1%, 5%, 10% levels respectively. Robust standard errors in brackets. All duration models include a full vector of sector dummy variables, not reported here for clarity. Variables are defined in Section 2.

(a) : p= 0.113 and (b) : p= 0.123

REFERENCES

Admati, A. R. and P. Pfleiderer (1994), "Robust financial contracting and the role of venture capitalists", *The Journal of Finance*, Vol.XLIX, N°2, pp. 371-402.

Amit, R., L. Glosten and E. Muller (1990), "Entrepreneurial ability, venture investments and risk sharing", *Management Science*, Vol.36, N°10, pp. 1232-1245.

Audretsch, D. and E. Lehmann (2004), "The effects of experience, ownership, and knowledge on IPO survival : evidence from the Neuer Markt", *Discussion paper N°04/10*.

Barry, C.B., C.J. Muscarella, J.W. Peavy and M.R. Vetsuypens (1990), "The role of venture capital in the creation of public companies: Evidence from the going-public process", *Journal of Financial Economics*, Volume 27, Issue 2, pp. 447–471.

Baum, J.A.C. and B.S. Silverman (2004), "Picking winners or building them? Alliance, intellectual, and human capital as selection criteria in venture financing and performance of biotechnology startups", *Journal of Business Venturing*, Vol.19, Issue 3, pp. 411-436.

Bottazzi, L. and M. Da Rin (2002), "Venture capital in Europe and the financing of innovative companies", *Economic Policy*, N°34, pp. 229-269.

____ ____ and T. Hellmann (2008), "Who are the active investors? Evidence from venture capital", *Journal of Financial Economics*, Vol. 89, Issue 3, pp. 488-512.

Brav, A. and P. Gompers (1997), "Myth or reality? The long-run underperformance of initial public offerings: evidence from venture- and non-venture-capital-backed companies", *Journal of Finance*, Vol. 52, pp. 1791-1822.

Broye, G. and A. Schatt (2003), "Sous-évaluation à l'introduction et cessions d'actions par les actionnaires d'origine : le cas français ", *Finance Contrôle Stratégie*, Volume 6, N° 2, pp. 67-89.

Bruton, G.D., I. Filatotchev, S. Chahine and M. Wright (2010), "Governance, ownership structure, and performance of IPO firms : the impact of different types of private equity investors and institutional environments", *Strategic Management Journal*, Vol. 31, pp. 491-509.

Carter, R. B., F.H. Dark and A.K. Singh (1998), "Underwriter reputation, initial returns, and the long-run performance of IPO stocks", *The Journal of Finance*, Vol. LIII, N°1, pp. 285-311.

___ and S. Manaster (1990), "Initial public offerings and underwriter reputation", *Journal of Finance*, Vol. 45, pp. 1045-1067.

Caves, R. E. (1998), "Industrial organization and new findings on the turnover and mobility of firms", *Journal of Economic Literature*, Vol. XXVI, pp. 1947-1982.

Cefis, E. O. and Marsili (2005), "A matter of life and death: innovation and firm survival", *Industrial and Corporate Change*, Volume 14, N° 6, pp. 1167–1192.

Chahine, S. and I. Filatotchev (2008), "The effects of venture capitalist affiliation to underwriters on short- and long-term performance in French IPOs", *Global Finance Journal*, Vol. 18, pp. 351–372.

___ ___ and M. Wright (2007), "Venture capitalists, business angels, and performance of entrepreneurial IPOs in the UK and France", J*ournal of Business Finance & Accounting*, Vol. 34, pp. 505–528.

Chaudhuri, S. and B. Tabrizi (1999), "Capturing the real value in high-tech acquisitions", *Harvard Business Review*, September-October.
Cleves, M., W.W. Gould and R. Gutierrez (2004), "An introduction to survival analysis using Stata", Stata Press, College Station TX.
Coakley, J., L. Hadass and A. Wood (2007), "Post-IPO operating performance, venture capital and the bubble years", *Journal of Business Finance & Accounting*, Vol. 34, pp. 1423-1446.
Cockburn, I., and S. Wagner (2010), "Patents and the survival of Internet-related IPOs", *Research Policy*, Vol.39, pp. 214-228.
Cumming, D.J. and J.G. MacIntosh (2001), "Venture capital investment duration in Canada and the United States", *Journal of Multinational Financial Management*, Vol. 11, pp. 445-463.
__ and S. Johan (2010), "Venture capital investment duration", *Journal of Small Business Management*, Vol. 48, N°2, pp. 228-257.
De Clercq, D., P.K. Goulet, M. Kumpulainen and M. Mäkelä (2001), "Portfolio investment strategies in the Finnish venture capital industry: A longitudinal study", *Venture Capital*, Vol. 3, N°1, pp. 41-62.
Dimov, D. and D. De Clercq (2006), "Venture capital investment strategy and portfolio failure rate: A longitudinal study", *Entrepreneurship Theory and Practice*, Vol. 30, N° 2, pp. 207-223.
Espenlaub, S., A. Khurshed and A. Mohamed (2012), "IPO Survival in a Reputational Market", *Journal of Business Finance & Accounting*, Vol. 39, pp. 427–463.
Esteve-Pérez, S., A. Sanchis-Llopis and J.A. Sanchis-Llopis (2010), "A competing risks analysis of firms' exit", *Empirical Economics*, N°38, pp. 281-304.
Evans, D. (1987), "The relationship between firm growth, size and age : estimates for 100 manufacturing industries", *The Journal of Industrial Economics*, Vol.XXXV, N°4, pp. 567-581.
Fontana, R. and L. Nesta (2009), "Product Innovation and Survival in a High Tech Industry", *Review of Industrial Organization*, Vol.34, N°4, pp. 287-306.
__ __ and S. Selosse (2007), "Innovation et sélection des firmes. L'industrie des équipements en réseaux locaux", *Revue de l'OFCE*, Vol.1, N° 100, pp. 121-142.

Fried, V.H., G.D. Bruton and R.D. Hisrich (1998), "Strategy and the board of directors in venture capital-backed firms", *Journal of Business Venturing*, Vol. 13, pp. 493-503.
Giot, P. and A. Schwienbacher (2007), "IPOs, trade sales and liquidations: Modelling venture capital exits using survival analysis", *Journal of Banking & Finance*, Vol. 31, pp. 679–702.
Goergen, M., A. Khurshed and L. Renneboog (2009), "Why are the French so different from the Germans? Underpricing of IPOs on the Euro New Markets", *International Review of Law and Economics*, Vol. 29, pp. 260–271.
Gompers, P. A. (1995), "Optimal investment, monitoring, and the staging of venture capital", *The Journal of Finance*, Vol.5, N°5, pp. 1461-1489.
__ (1996), "Grandstanding in the venture capital industry", *Journal of Financial Economics*, Vol. 42, Issue. 1, pp. 133–156.
__ and J. Lerner (2004), "The venture capital cycle", MIT Press, second edition.

Hasan, I. and H. Wang (2008), "The US bankruptcy law and private equity financing: empirical evidence", *Small Business Economics*, N°31, pp. 5-19.
Hellmann, T. and M. Puri M (2002), "Venture capital and the professionalization of start-up firms: empirical evidence", *The Journal of Finance*, Vol. LVII, N°1, pp. 169-198.
Hensler, D.A., R.C. Tutherford and T.M. Springer (1997), "The survival of initial public offerings in the aftermarket", *The Journal of Financial Research*, Vol. XX, pp. 93-110.
Jain, A. and O. Kini O. (1994), "The post-issue operating performance of IPO firms", *The Journal of Finance*, VOL. XLIX, N°5, pp. 1699-1726.
__ __ (1995), "Venture capitalist participation and the post-issue operating oerformance of IPO firms", *Managerial and Decision Economics*, Vol.16, pp. 593- 606.
__ __ (2000), "Does the presence of venture capitalists improve the survival profile of IPO firms?", *Journal of Business Finance & Accounting*, Vol.27, Issue 9&10, pp. 1139-1176.
Jenkins, S.P. (2005), "Survival analysis", Unpublished manuscript, Institute for Social Science and Economic Research, University of Essex, Colchester, UK Downloadable from : http ://www.iser.essex.ac.uk/study/resources/module-ec968.
Kaplan, S. N. and P. Strömberg (2003), "Financial contracting theory meets the real world: an empirical analysis of venture capital contracts", *Review of Economic Studies*, Vol. 70, pp. 281-315.
Khurshed, A., S. Paleari and S. Vismara (2005), "The operating performance of initial public offerings: the UK experience", Working Papers Series, SSRN.
Kortum, S. and J. Lerner (2000), "Assessing the contribution of venture capital to innovation", *RAND Journal of Economics*, Vol. 31, N°4, pp. 674-692.
Lee, P.M. and S. Wahal (2004), "Grandstanding, certification and the underpricing of venture capital backed IPOs", *Journal of Financial Economics*, Vol. 73, pp. 375–407.
Lerner, J. (1994a), "Venture capitalists and the decision to go public", *Journal of Financial Economics*, Vol. 35, N°1, pp. 293-316.
__ (1994), "The Syndication of Venture Capital Investments ", *Financial Management*, Vol. 23, N° 3, p. 6-27.
Manigart, S., K. Baeyens and W.V. Hyfte (2002), "The survival of venture capital backed companies", *Venture Capital*, Vol. 4, N°2, pp. 103-124.
Mayer, C., K. Schoorsand and Y. Yafeh (2005), "Sources of funds and investment activities of venture capital funds: evidence from Germany, Israel, Japan and the United Kingdom", *Journal of Corporate Finance*, Vol. 11, pp. 586–608.
McConnell, J.J. and H. Servaes (1990), "Additional evidence on equity ownership and corporate value", *Journal of Financial Economics*, Vol. 27, pp. 595-612.
Megginson, W.L. and K.A. Weiss (1991), "Venture capitalist certification in initial public offerings", *The Journal of Finance*, Vol. XLVI, N°3, pp. 879-903.
Narandranathan, W. and M. Stewart (1991), "Simple methods for testing the proportionality of cause-specific hazards in competing risks models", *Oxford Bulletin of Economics and Statistics*, Vol. 53, pp. 331-340.
Rinderman, G. (2003), "Venture capitalist participation and the performance of IPO firms. Empirical evidence from France, Germany and the UK", (Frankfurt: Peter Lang).
Sahlman W. (1990), "The Structure and Governance of Venture-Capital Organization", *Journal of Financial Economics*, Vol. 27, pp. 473-521.

Sapienza, H. J. and A.K. Gupta (1994), "Impact of agency risks and task uncertainty on venture capitalist-ceo interaction", *Academy of Management Journal*, Vol. 37, N°6, pp. 1618-1632.
__ S. Manigart and W. Vermeir (1996), "Venture capitalist governance and value added in four countries", *Journal of Business Venturing*, Vol.11, pp. 439-469.
Schary, M.A. (1991), "The probability of exit", *RAND Journal of Economics*, Vol. 22, N°3, pp. 339-353.
Sentis, P. (2009), "Insider trading, pricing and the long-run performance of IPOs: evidence from the French market during the high-tech bubble", *Venture Capital*, Vol. 11, N° 2, pp.107-132.
Serve, S. (2007), "L'impact de l'admission à la cote sur les performances économiques des entreprises", *Finance*, Vol. 28, N°2, p.79-120.
Séverin, E. (2001), "Ownership structure and the performance of firms: Evidence from France", *European Journal of Economic and Social Systems*,Vol. 15, N° 2, pp. 85-107.
Shleifer, A. and R.W. Vishny (1989), "Managerial entrechment: The case of manager-specific investments", *Journal of Financial Economics*, Vol. 25, pp. 123-139.
Storey, D. J. and B.S. Tether (1998), "New technology-based firms in the European union : an introduction", *Research Policy*, Vol.26, Issue 9, pp. 933-946.
Tykvová, T. (2006), "How do investment patterns of independent and captive private equity funds differ ? Evidence from Germany", *Financial Markets and Portfolio Management*, Vol.20, N°4, pp. 399-418.
Villalonga, B. (2004), "Intangible resources, Tobin's q, and sustainability of performance differences", *Journal of Economic Behavior & Organization*, Vol.54, pp. 205-230.
Wang, C.K., K. Wang and Q. Lu (2003), "Effects of venture capitalists' participation in listed companies", *Journal of Banking & Finance*, Vol. 27, pp. 2015–2034.

Table 1: Descriptive statistics on variables used in the regression

Variables	Total sample (N=212)		VC (N=125)		NVC (N=87)		T-Diff mean (median)
	Mean (sd)	Median	Mean	Median	Mean	Median	
Age (Years)	10.29	9.00	10.16	8.00	10.48	9.00	_
	(7.57)		(7.73)		(7.37)		
Size (M Euros)	68.31	34.23	87.03	44.56	41.42	18.94	# (#)
	(91.80)		(107.53)		(52.57)		
Growth Rate	0.25	0.19	0.26	0.22	0.25	0.18	_
	(0.37)		(0.38)		(0.36)		
Investment Bank Reputation	0.55	1.00	0.45	0.00	0.67	1.00	***
	(0.50)		(0.50)		(0.47)		
Insider Ownership (%)	74.86	75.97	66.65	66.28	86.65	92.75	# (#)
	(23.87)		(19.92)		(24.25)		
Intangibles Ratio	0.14	0.08	0.14	0.08	0.13	0.09	_
	(0.16)		(0.17)		(0.14)		
Patent	1.67	0.00	2.38	0.00	0.65	0.00	***(***)
	(4.75)		(5.72)		(2.55)		
Year dummies							
1998	0.15	0.00	0.16	0.00	0.14	0.00	_
	(0.36)		(0.37)		(0.35)		
1999	0.12	0.00	0.15	0.00	0.08	0.00	_
	(0.33)		(0.36)		(0.27)		
2000	0.23	0.00	0.22	0.00	0.24	0.00	_
	(0.42)		(0.42)		(0.43)		
Industry dummies							
ITS	0.38	0.00	0.37	0.00	0.39	0.00	_
	(0.48)		(0.48)		(0.49)		
NHT	0.17	0.00	0.16	0.00	0.18	0.00	_
	(0.38)		(0.37)		(0.39)		
Media	0.12	0.00	0.12	0.00	0.13	0.00	_
	(0.33)		(0.33)		(0.33)		
Telecom	0.07	0.00	0.08	0.00	0.06	0.00	_
	(0.26)		(0.27)		(0.23)		
Life Sciences	0.07	0.00	0.10	0.00	0.05	0.00	_
	(0.26)		(0.29)		(0.21)		
Other	0.18	0.00	0.18	0.00	0.19	0.00	_
	(0.39)		(0.38)		(0.40)		

Notes : #, ***, **, * significant at the 0.1%, 1%, 5%, 10% levels respectively.

The sample includes 125 VC-backed IPOs and 87 non-VC-backed IPOs during the period 1996-2006. *Age* is calculated as the difference (in years) between company's founding and IPO dates. *Size* is the market capitalization of the IPO firm at the IPO price (expressed as millions euros). *Growth Rate* is the difference in firm employee numbers at the time of IPO and 1 year after (difference measured in natural logarithm). *Investment Bank Reputation* is a dummy that takes the value 1 if the IPO is backed by reputable lead investment bank and 0 otherwise. *Insider Ownership* is the percentage of shares held by board members at the time of IPO. *Patent* is the number of patent owned by the company at the time of IPO. *Intangibles Ratio* is the capitalized amount of intangible assets divided by total assets.

Table 2 : Descriptive statistics for listed and delisted IPOs

Variables	IPO still trading (N=132)		IPO Delisted (N=80)		T-Diff mean (median)
	Mean (sd)	Median	Mean (sd)	Median	
Age (Years)	10.85 (7.18)	9.00	9.37 (8.13)	8.00	_(**)
Size (M Euros)	72.80 (89.40)	39.30	61.00 (95.70)	22.00	_(**)
Growth Rate	0.29 (0.38)	0.24	0.20 (0.35)	0.15	_(*)
Venture Capital	0.60 (0.49)	1.00	0.57 (0.50)	1.00	_
VC Number	1.77 (2.29)	1.00	2.00 (2.39)	1.00	_
VCEarly	0.23 (0.43)	0.00	0.20 (0.40)	0.00	_
VCExpansion	0.23 (0.42)	0.00	0.15 (0.36)	0.00	_
VCBridge	0.14 (0.34)	0.00	0.21 (0.41)	0.00	_
Investment Bank Reputation	0.54 (0.50)	1.00	0.56 (0.50)	1.00	_
Insider Ownership (%)	72.94 (23.42)	73.55	78.03 (24.42)	79.97	_(*)
Intangibles Ratio	0.13 (0.14)	0.09	0.15 (0.18)	0.08	_
Patent	1.98 (4.70)	0.00	1.17 (4.83)	0.00	_(*)
Year dummies					
1998	0.09 (0.29)	0.00	0.25 (0.43)	0.00	***
1999	0.12 (0.33)	0.00	0.12 (0.33)	0.00	_
2000	0.22 (0.41)	0.00	0.25 (0.44)	0.00	_
Industry dummies					
ITS	0.37 (0.48)	0.00	0.39 (0.49)	0.00	_
NHT	0.17 (0.38)	0.00	0.16 (0.37)	0.00	_
Media	0.14 (0.34)	0.00	0.10 (0.30)	0.00	_
Telecom	0.05 (0.22)	0.00	0.10 (0.30)	0.00	_
Life Sciences	0.09 (0.29)	0.00	0.05 (0.22)	0.00	_

Other	0.17	0.00	0.20	0.00	_
	(0.38)		(0.40)		

Notes : ***, **, * significant at the 1%, 5%, 10% levels respectively.
For our sample of 212 firms listed during the period 1996-2006, the table shows means, medians and standard deviations of the variables separately for firms that survived to December 2012 and firms that had been delisted by December 2012. The variables are defined in Section 3.

Table 3: Mean (median) time (in years) until delisting. The table is based only on the 80 IPOs which were delisted from the market within the sample period.

	M&A		Liquidation		Total Delisting	
Variables	Duration mean (median)	Obs	Duration mean(median)	Obs	Duration mean(median)	Obs
VC-backed	5.833(5.000)	24	6.727(6.000)	22	6.260(6.000)	46
VCEarly	6.200(5.500)	10	6.833(6.000)	6	6.437(6.000)	16
VCExpansion	6.400(5.000)	5	7.571(7.000)	7	7.083(7.000)	12
VCBridge	5.375(5.500)	9	6.000(5.000)	9	5.705(5.000)	18
Non-VC-backed	7.913(9.000)	23	5.636(5.000)	11	7.176(7.500)	34

The variables are defined in Section 3.

Table 4: Competing and single risk estimates (AFT model)

VARIABLES	(1) All Exit Coeff	(1) All Exit TR	(2) M&A Coeff	(2) M&A TR	(3) Liquidation Coeff	(3) Liquidation TR
Age	0.019	1.019	-0.048	0.953	0.097***	1.101
	[0.023]		[0.050]		[0.036]	
Age2	-0.001*	0.999	0.001	1.001	-0.002***	0.998
	[0.000]		[0.002]		[0.001]	
Ln(size)	0.051	1.052	0.004	1.004	0.023	1.023
	[0.069]		[0.083]		[0.091]	
Growth Rate	0.412**	1.509	0.483**	1.621	0.212	1.236
	[0.197]		[0.236]		[0.261]	
Investment Bank Reputation	0.190	1.209	0.158	1.171	0.182	1.200
	[0.152]		[0.211]		[0.178]	
Insider Ownership	-0.007**	0.993	-0.002	0.998	-0.012***	0.988
	[0.003]		[0.004]		[0.004]	
VC Number	-0.088**	0.916	-0.114**	0.892	-0.035	0.965
	[0.042]		[0.053]		[0.050]	
VCEarly	0.052	1.054	0.214	1.239	-0.305	0.737
	[0.279]		[0.367]		[0.352]	
VCExpansion	0.261	1.298	0.894**	2.446	-0.697*	0.498
	[0.271]		[0.360]		[0.363]	
VCBridge	-0.224	0.799	0.050	1.051	-0.665**	0.514
	[0.246]		[0.333]		[0.302]	
Intangibles Ratio	-0.715	0.489	-1.834***	0.160	1.586*	4.885
	[0.478]		[0.504]		[0.820]	
Ln(patent)	0.282**	1.326	0.634***	1.885	0.049	1.050
	[0.124]		[0.221]		[0.145]	
Year 1998	-0.416**	0.660	-0.176	0.839	-0.607**	0.545
	[0.205]		[0.270]		[0.255]	
Year 1999	-0.149	0.861	-0.130	0.878	0.024	1.024
	[0.231]		[0.286]		[0.307]	
Year 2000	-0.382	0.682	-0.481	0.618	-0.035	0.965
	[0.243]		[0.320]		[0.333]	
Constant	4.690***		5.162***		9.874***	
	[1.276]		[1.472]		[1.557]	
Observations	212	212	212	212	212	212
Nb Exits	80	80	47	47	33	33
Log Likelihood	-163.334	-163.334	-113.078	-113.078	-79.543	-79.543
Wald Chi square	58.37***		51.97***		219.99***	

Notes : ***, **, * significant at the 1%, 5%, 10% levels respectively. Robust standard errors in brackets. All duration models include a full vector of sector dummy variables, not reported here for brevity. The variables are defined in Section 3. The Time Ratio (TR) is calculated as the exponential of the estimated coefficient, exp(β). A time ratio greater than 1 indicates that an increase in the covariate increases survival time (or equivalently, slows down failure). For instance, the time ratio of *Growth Rate* ranges from 1.509 to 1.523 indicating that survival time increases by a multiple of 1.509 to 1.523 as *Growth Rate* increases by one unit, or equivalently that a one-unit increase in *Growth Rate* increases survival time by between 51% and 52%.

Table 5: AFT model for normal (1996-1997 and 2001-2006) and hot markets (1998-2000). Exits are treated as a homogeneous event.

All Exits	(1)	(1)	(2)	(2)	(3)	(3)	(4)	(4)
Bubble period	Yes	Yes	Yes	Yes	No	No	No	No
VARIABLES	Coeff	TR	Coeff	TR	Coeff	TR	Coeff	TR
Age	0.070	1.073	0.053	1.054	0.003	1.003	0.003	1.003
	[0.052]		[0.054]		[0.022]		[0.023]	
Age2	-0.002	0.998	-0.002	0.998	-0.000	1.000	-0.000	1.000
	[0.002]		[0.002]		[0.000]		[0.000]	
Ln(size)	0.111*	1.117	0.119*	1.126	0.029	1.029	0.012	1.012
	[0.067]		[0.067]		[0.073]		[0.073]	
Growth Rate	0.443*	1.557	0.432*	1.540	0.673*	1.960	0.589[a]	1.802
	[0.240]		[0.238]		[0.409]		[0.368]	
Invest. Bank Reputation	-0.068	0.934	-0.061	0.941	0.564***	1.758	0.583***	1.792
	[0.209]		[0.213]		[0.193]		[0.196]	
Insider Ownership(%)	-0.006	0.994	-0.006	0.994	-0.006*	0.994	-0.006*	0.994
	[0.005]		[0.005]		[0.003]		[0.003]	
Venture Capital	-0.734***	0.480			0.231	1.260		
	[0.270]				[0.243]			
VC Number			-0.118*	0.889			-0.141*	0.868
			[0.062]				[0.076]	
VCEarly			-0.304	0.738			0.982**	2.669
			[0.388]				[0.487]	
VCExpansion			0.161	1.175			0.422	1.524
			[0.441]				[0.326]	
VCBridge			-0.467	0.627			0.430	1.537
			[0.344]				[0.308]	
Intangibles Ratio	0.779	2.179	0.727	2.070	-1.373***	0.253	-1.280***	0.278
	[0.773]		[0.760]		[0.436]		[0.417]	
Ln(patent)	0.122	1.130	0.066	1.068	0.753***	2.124	1.025***	2.787
	[0.163]		[0.147]		[0.219]		[0.263]	
Constant	3.576***		3.507**		3.395***		3.446***	
	[1.333]		[1.394]		[1.243]		[1.207]	
Observations	107	107	107	107	105	105	105	105
Nb Exits	50	50	50	50	30	30	30	30
Log Likelihood	-98.424	-98.424	-97.246	-97.246	-51.030	-51.030	-48.421	-48.421
Wald Chi square	24.68**		25.88*		113.70***		120.13***	

Notes : ***, **, * significant at the 1%, 5%, 10% levels respectively. Robust standard errors in brackets. All duration models include a full vector of sector dummy variables, not reported here for clarity. The sample is divided into two sub-samples: the hot market period (1998-2000) with the bubble period=Yes (Models 1 and 2) and the normal period (1996-1997/2001-2006) with bubble period= No (Models 3 and 4). All the models show the results for exits treated as a homogeneous event. The variables are defined in Section 3.
Model 2: p-value=0.07. Model 4: (a): p= 0.109.

Table 6: Competing and single risk estimates (Cox PH model)

VARIABLES	(1) All Exit Coeff	(1) All Exit HR	(2) M&A Coeff	(2) M&A HR	(3) Liquidation Coeff	(3) Liquidation HR
Age	-0.056	0.945	0.023	1.023	-0.162**	0.850
	[0.039]		[0.053]		[0.068]	
Age2	0.002***	1.002	-0.000	1.000	0.004***	1.004
	[0.001]		[0.001]		[0.001]	
Ln(size)	-0.122	0.885	-0.085	0.919	-0.071	0.931
	[0.114]		[0.139]		[0.183]	
Growth Rate	-0.594*	0.552	-0.643*	0.526	-0.664	0.515
	[0.343]		[0.367]		[0.714]	
Investment Bank Reputation	-0.174	0.840	-0.080	0.923	-0.208	0.812
	[0.252]		[0.351]		[0.370]	
Insider Ownership(%)	0.011**	1.011	0.006	1.006	0.018**	1.018
	[0.005]		[0.007]		[0.007]	
VC Number	0.157**	1.170	0.231**	1.259	0.096	1.100
	[0.071]		[0.096]		[0.109]	
VCEarly	-0.263	0.769	-0.712	0.491	0.319	1.376
	[0.505]		[0.650]		[0.808]	
VCExpansion	-0.508	0.601	-1.603**	0.201	0.762	2.142
	[0.505]		[0.725]		[0.746]	
VCBridge	0.049	1.050	-0.412	0.662	0.800[b]	2.226
	[0.381]		[0.509]		[0.586]	
Intangibles Ratio	1.052	2.862	3.175***	23.929	-3.540*	0.029
	[0.941]		[0.902]		[1.875]	
Ln(patent)	-0.351[a]	0.704	-0.923*	0.397	0.121	1.129
	[0.236]		[0.472]		[0.280]	
Year 1998	0.612*	1.844	0.227	1.255	0.977**	2.656
	[0.324]		[0.432]		[0.498]	
Year 1999	0.499	1.647	0.705	2.024	0.096	1.101
	[0.398]		[0.498]		[0.613]	
Year 2000	0.412	1.510	0.568	1.764	-0.145	0.865
	[0.417]		[0.524]		[0.776]	
Observations	212	212	212	212	212	212
Nb Exits	80	80	47	47	33	33
Log Likelihood	-383.882	-383.882	-214.848	-214.848	-146.011	-146.011
Wald Chi square	85.41***		51.90***		15374.72***	

Notes : ***, **, * significant at the 1%, 5%, 10% levels respectively. Robust standard errors in brackets. All duration models include a full vector of sector dummy variables, not reported here for brevity. Variables are defined in Section 2.
(a): p-value= 0.136
(b): p-value= 0.172

Table 7 : Competing and single risk estimates (AFT model) with alternative measures for the variables *VCExpansion* and *VCBridge*

	(1)	(3)	(5)	(7)	(9)	(11)
	Coeff	TR	Coeff	TR	Coeff	TR
VARIABLES						
Age	0.020	1.020	-0.055	0.946	0.101***	1.106
	[0.023]		[0.053]		[0.036]	
Age2	-0.001*	0.999	0.001	1.001	-0.002***	0.998
	[0.000]		[0.002]		[0.001]	
Ln(size)	0.056	1.057	0.007	1.007	0.030	1.030
	[0.070]		[0.083]		[0.094]	
Growth Rate	0.426**	1.532	0.492**	1.636	0.214	1.239
	[0.192]		[0.232]		[0.260]	
Investment Bank Reputation	0.201	1.223	0.147	1.158	0.238	1.269
	[0.150]		[0.207]		[0.177]	
Insider Ownership(%)	-0.008**	0.993	-0.003	0.997	-0.012***	0.988
	[0.003]		[0.004]		[0.004]	
VC Number	-0.086**	0.918	-0.107**	0.899	-0.053	0.948
	[0.040]		[0.053]		[0.049]	
VCEarly	0.011	1.011	0.140	1.150	-0.227	0.797
	[0.261]		[0.352]		[0.338]	
VCExpansion	0.339	1.404	0.837**	2.310	-0.356	0.700
	[0.248]		[0.341]		[0.358]	
VCBridge	-0.324*	0.723	-0.092	0.912	-0.600***	0.549
	[0.193]		[0.283]		[0.227]	
Intangibles Ratio	-0.737	0.479	-1.798***	0.166	1.393*	4.029*
	[0.471]		[0.496]		[0.794]	
Ln(patent)	0.283**	1.327	0.629***	1.876	0.024	1.024
	[0.120]		[0.219]		[0.152]	
Year 1998	-0.403*	0.668	-0.146	0.864	-0.599**	0.549
	[0.206]		[0.267]		[0.262]	
Year 1999	-0.125	0.883	-0.113	0.893	0.051	1.052
	[0.229]		[0.288]		[0.301]	
Year 2000	-0.378	0.685	-0.477	0.620	-0.024	0.976
	[0.239]		[0.317]		[0.324]	
Constant	4.603***		5.191***		9.677***	
	[1.269]		[1.469]		[1.616]	
Observations	212	212	212	212	212	212
Nb Exits	80	80	47	47	33	33
Log Likelihood	-162.323	-162.323	-113.033	-113.033	-78.763	-78.763
Wald Chi square	56.83***		48.27***		214.90	

Notes : ***, **, * significant at the 1%, 5%, 10% levels respectively. Robust standard errors in brackets. All duration models include a full vector of sector dummy variables, not reported here for brevity. Variables are defined in Section 2.